

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : F01C	A2	(11) International Publication Number: WO 00/23691
		(43) International Publication Date: 27 April 2000 (27.04.00)
(21) International Application Number: PCT/US99/24141	(81) Designated States: BR, JP, RU, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) International Filing Date: 16 October 1999 (16.10.99)		
(30) Priority Data: 09/173,828 16 October 1998 (16.10.98) US	Published <i>Without international search report and to be republished upon receipt of that report.</i>	
(71)(72) Applicant and Inventor: VAZQUEZ, Jesus [US/US]; Calle Alameda B-13, Sta. Juanita, Bayamon, Puerto Rico 00956 (US).		
(54) Title: REVOLVING PISTON ROTARY TOROIDAL CYLINDER INTERNAL COMBUSTION, WATER, STEAM, FLUID AND QUANTUM ENGINE ALSO PUMP, METERING DEVICE AND ASSIST UNITS ALL SIZES		
(57) Abstract A revolving piston rotary toroidal cylinder valved expandable chamber device, compressor and engine machine system with an outer toroidal cylinder housing assembly having a central axis, having one or a plurality of balanced pistons with means for attachment to a rotor and radiating through the outer rotor assembly to contact the interior surface of the outer housing at the other extreme of the pistons, whereby, a plurality of relatively air tight compartments are formed between the interior surface of the outer housing, the outer surface of the rotor assembly and the piston or plurality of pistons with the volume of said compartment varying as a function of the rotative position of the inner cylinder and rotor assembly in relation to the isolating valve. The rotary device can be used as a compressor having an inlet for receiving air and an outlet for providing compressed air. The rotary device can also have an inlet for receiving working fluid and an exhaust port for venting working fluid, a combustor for burning combustible fluids. The combustor (combustion chamber) can also heat an expansion gas or fluid which are introduced and or mixed within the combustor simultaneously.		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	JP	Japan	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	KE	Kenya	NL	Netherlands	VN	Viet Nam
CG	Congo	KG	Kyrgyzstan	NO	Norway	YU	Yugoslavia
CH	Switzerland	KP	Democratic People's Republic of Korea	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KR	Republic of Korea	PL	Poland		
CM	Cameroon	KZ	Kazakhstan	PT	Portugal		
CN	China	LC	Saint Lucia	RO	Romania		
CU	Cuba	LI	Liechtenstein	RU	Russian Federation		
CZ	Czech Republic	LK	Sri Lanka	SD	Sudan		
DE	Germany	LR	Liberia	SE	Sweden		
DK	Denmark			SG	Singapore		
EE	Estonia						

Revolving piston rotary toroidal cylinder internal combustion, water, steam, fluid and quantum engine also pump, metering device and assist units all sizes

Background—Field of Invention

This invention in its embodiment as an internal combustion engine would be the first truly significant new rotary internal combustion engine design since the invention of the Otto cycle engine by the German engineer, Nikolaus August Otto in 1861. This was followed by the invention of the diesel engine by the German engineer, Rudolf Diesel in 1896. Both of the latter are still basically the same design; four and two cycle reciprocating pistons. These two men changed the form of transportation for the entire world. Then came the Wankel off center "rotary" engine (not a true rotary) where the piston is basically a round cornered triangle but still a four cycle engine invented by the German, Felix Wankel in 1954. Prior to Mr. Wankel, the Englishman, Mr. Frank Whittle invented the jet turbine engine in 1930. The RP-7V revolving piston rotary internal combustion engine overcomes the limitations of gasoline as a fuel and combines the positive displacement of the conventional Otto cycle engine with the dynamic effect of a jet turbine engine yielding high torque at low and high rpm. This motor is a new technology that would not displace the current fuel supply infrastructure (it would utilize ordinary gas stations). With the steam power assist unit this engine would be the most adiabatic engine to date. This engine could better utilize available fuels including renewable fuel sources.

Objects and Advantages

A. This invention in its embodiment as an engine is more efficient for the following reasons:

1. It is perfectly rotary (unlike the Wankel engine).
2. It combines the positive displacement of a conventional internal combustion engine with the dynamic effect of a jet turbine engine.
3. Utilizes, does not waste low pressures (contrary to the minimum pressure required by a turbine).
4. Does not utilize a reciprocating motion that wastes energy changing directions (momentum, impetus, inertia).
5. Does not waste energy in cycles such as the four (4) and two (2) cycles of the conventional Otto, Diesel or Wankel engines. In the four (4) cycle engine only one (1) out of four (4) cycles provides power.
6. Does not waste power on a compression cycle.
7. Does not waste power on conventional cam shafts.
8. Does not waste power on conventional valves and springs.
9. Can function without a starter.
10. It can utilize excess heat that would normally be wasted (steam power assist and Thermoelectric devices). In conventional engines the radiator wastes 33% of the fuel's energy (more adiabatic).
11. Utilizes turbo charger(s) to supply oxidizer (air).
12. Utilizes electric fuel pump.
13. Utilizes flywheel effect.
14. Can utilize ultra high efficiency lubricants permanently bonded to critical surfaces with coefficients of friction of only 0.001 as opposed to the conventional 1.0.

15. The possible combinations of various versions that increase efficiency.
16. Design permits the complete control of ratios of fuel to air.
17. Can be combined with electric motor/generator in a hybrid configuration.
18. Because of the nature of the combustion there is no such thing as detonation, piston knock or pre-ignition. This engine compensates for the deficiencies or limitations of gasoline as a fuel. These being: ratios of air to fuel, its relatively low octane content and the tendency for gasoline to produce detonations, piston knock or pre-ignition.
19. Can use many types of fuel.
20. Utilizes gasoline more efficiently.
21. Is simpler in construction.
22. Has very few moving parts (only two in its basic configuration).

B. This engine is more durable for the following reasons:

1. Simple design, less moving parts, smaller, lighter, oblique angles.
2. Rotation only in one direction avoids wear caused by changing directions (180 degrees) on the parts. Reciprocating action tends by its nature to hammer the following parts: connecting rods, rings, bushings, bearings, cam shafts, cams, cylinders, pistons, crank shafts, etc.
3. Permits superior design and function of the piston rings because of one way rotation.
4. Less vibrations.
5. Utilizes ultra high efficiency lubricants permanently bonded to the critical surfaces.
6. Forms strong components geometrically designed for maximum strength (toroids and cones).
7. Controlled operating conditions of the critical parts.
8. Can utilize new materials such as carbon carbon composites that can resist higher temperatures yet do not expand as much as metal permitting smaller tolerances

at the same time being stronger and more malleable.

9. Because of the nature of the design of the engine and its form of combustion there never is ping, piston knock or detonation. These being potentially the most destructive for a conventional engine. Piston knock or detonation is a form of abnormal combustion, hot gases left over from the previous combustion spontaneously detonate. This knock produces a spike of ultra high pressure, a shock wave that can break pistons or rings and radically increase combustion chamber temperature. This increases the possibility that red-hot glowing metal in the combustion chamber will result in pre-ignition, at which point successive combustion events are ignited not by the spark plug, but by the hot spots. Timing is then completely out of control, leading to further temperature rises and the possibility of melted pistons etc.

C. This engine is easier to manufacture for the following reasons:

1. The toroid cylinder is manufactured in two halves, then is put together with gaskets and bolts etc.
 2. The water jackets are manufactured and put together in the same way as the cylinders and bolted on over the latter.
 3. The design is simple.
 4. Can utilize new materials and simplified methods.
 5. Would be more economical to manufacture.
- D. This invention in its embodiment as a pump, a power assist device, a metering device, a water engine for hydro-electric purposes, a steam engine and a quantum motor is more efficient, durable and easy to manufacture for the reasons stated above in its internal combustion mode except without a combustor and fuel supply.

Drawing figures

Fig. 1 is a schematic isometric front view of one type of the RP-7V circular/circular (round) version toroidal cylinder assembly.

Fig. 2 is an exploded view of Fig. 1, including front and back of two pistons mounted on the rotor. Also showing bearings and axle shaft.

Fig. 3 is a side view of a three piston round version with attached combustor and double inner reaction cages. A continuous internal combustion engine mode, including valve for round piston with counter balanced actuator lever, diffuser, primary and secondary air supply lines all with pressure and check valves. Also shown are exhaust port and manifold.

Fig. 4 is a detailed side view of a three piston rectangular toroid cylinder and piston valved version of the internal combustion engine. Embodiments showing exhaust port, manifold and purge tube, turbinal type regenerative fuel line, primary and secondary air supply lines with check valves, electric air pump, reserve air tank, supercharger, rotor and axle.

Fig. 5 is an internal combustion engine in which the pistons and cylinder are of the rectangular version and the engine is positioned so as the roller tipped valve is free (no actuator), gravity balanced to where the force of combustion keeps the valve pressed against the sloped back surface of the piston. Also shown: combustor, diffuser, exhaust port/manifold and rotational direction.

Fig. 6 is a detailed side view of the invention in a double independent valve circular/circular (round) toroid and piston configuration. In this round air lock type version there is always a closed valve after the passage of the piston completely sealing the retrograde escape of gases, etc. This and its single valve version, as well as its rectangular and other shaped versions are also a preferred embodiment of the invention as a pump, a power assist device, a metering device, a water engine for hydro-electric purposes, a steam engine and a quantum motor. All of the above in any size. Adding a combustor and moving the exhaust port would convert this version into an internal combustion engine.

Fig. 7 is the same as Fig. 6 but with a rectangular two piston and toroid version. The added

combustors and exhaust port position portrays it in an internal combustion engine configuration.

Fig. 8 is one of the pump embodiments of the invention in its basic structure only that this version has a reversed valve that can have a roller bearing type tip allowing it to ride the sloped back of the piston(s) and as it does the quickly decreasing volume forces the air out of the exhaust port until the valve itself closes because of the piston's pressure. The shape of the valves may vary. In the exhaust port there may be a one way check or pressure valve. The pump embodiment may also take other forms or shapes (rectangular, oval, triangular, etcetera) or be in other versions such as the valve facing the conventional direction controlled by various types of actuators to hold the valves in place, open or closed, in order for them to do their work. The sloped back of the piston may extend as much as up to the top or face of the previous or receding piston.

Fig. 8A includes all of the elements and descriptions of figure 8 except that it additionally contains an accumulator by-pass neck 61.

Fig. 9 is similar in basic design to the previous versions of round torus internal combustion engine version except that it shows additionally an exhaust purge tube that connects to the exhaust manifold. Oil and water lines feed through the axle shaft separately and into the rotor and piston heads. The oil then seeps out between the piston rings and in again through the inlets to be pumped down to the oil cooler to be recirculated. The coolant or water is routed through the piston and returned to be cooled and/or its steam to be collected. Also shown is a water cooled diffuser/steam generator, a steam or water recovery tube and a stylized turbo charger in the exhaust manifold. The combustor generates the gases that move the pistons and utilizes a turbinal regenerative cooler/heater that vaporizes the fuel while cooling the combustor..

Fig.10 through Fig. 15 shows the rotational sequence of the rotor and pistons in relation to the valve position.

Fig. 16 is a front edge on view of a version of the invention in its round piston cylinder configuration in which a different angle of the oil and water compartments is illustrated and

their distribution through the axle shaft, rotor and through their various routes from reservoir through their designed function, through their respective cooling processes and back again. Also shown is the way the combustor is attached to the toroid cylinder. This compound compartmentalized version is one of various configurations.

Fig. 17 is a color rendition of the invention in its embodiments as an internal combustion engine. It clearly shows the basic process that power this engine. Additionally it shows the fresh air/exhaust purge tube which allows a type of conditioning of the piston and cylinder area prior to its cycling back to its combustion position. It also shows a hot water or steam recovery line. In summary basically what this figure shows is the way that the combustor drives the piston and is isolated from retrograde flow and is exhausted through the exhaust port and manifold.

Fig. 18 is an exploded schematic isometric front view of the invention in a preferred embodiment

as an internal combustion engine in a rectangular/rectangular configuration whose exterior may be air cooled. The cooling vanes also act as bearing supports.

Fig. 19 is a side view of the above embodiment also showing that it is in a two piston rotor configuration and showing its fresh air exhaust purge system.

Fig. 20 is the same embodiment as Fig. 18 and Fig. 19 only that it is in a round cylinder configuration.

Fig. 21 is also in an internal combustion embodiment except that this version is an air breathing or sucking version meaning that this version is not force fed air as the other continuous combustion models. As a consequence this model cycles between detonations in order to supply itself with the fresh air necessary for combustion. Additionally this model is also a double valve version in which the exhaust purge valve faces the opposite direction from the traditional piston isolating valve in this version as well as in others.

Fig. 22 the only difference in this embodiment of the round toroid cylinder engine is that it has a small turbocharger that runs off of the exhaust purge to draw in fresh air to supplement the air

in the combustor for combustion.

Figs. 23, 24, 25 and 26 are different views of the same engine and indicate that it is a round air cooled toroid cylinder with optional covers that would either concentrate heat for steam generation or for converting it into a water cooled version and Fig 25 also helps one visualize what the exterior of this engine would look like.

Figs. 27, 28, 29 and 30 illustrate the same as Figs. 23, 24, 25 and 26 except in a rectangular toroid version with an extended exhaust port eliminating the need for a purge tube.

List of Reference Numerals

- 30. External support convex conical structure.
- 31. Ribbed external support heat transfer structure.
- 32. Internal support concave conical structure.
- 33. Ribbed internal support heat transfer structure and water jacket element.
- 34. Internal toroidal cylinder structure.
- 34A. Whole round toroidal cylinder assembly.
- 34B. Whole rectangular toroidal cylinder assembly.
- 34C. Outer bearing support/heat transfer structure.
- 35. Axle shaft area.
- 36. Outer bearing bevels (4).
- 36A. Inner bearing bevels.
- 37. Perimeter bolt holes.
- 37A. Perimeter bolts.
- 38. Outer cylinder ring seal grooves.
- 38A. Outer rotor ring seal grooves.
- 39. Rotor area.
- 39A. Rotor
- 40. Piston cylinder area.
- 40A. Concave piston top.
- 41. Slopped piston back.
- 42. Bearing.
- 43. Bearing retainer.
- 44. Inner cylinder ring seal groove.
- 44A. Inner rotor ring seal groove.
- 45. Inner ring seal.
- 46. Outer ring seal.

- 47. Inner bearing.
- 48. Outer rotor seal.
- 49. Axle shaft.
- 50. Inner bearing retainer seal.
- 51. Secondary air supply line with check valves.
- 51A. Secondary air intake with check valves.
- 52. Primary inner air supply line with check valves.
- 53. Fuel supply lines with check valves.
- 54. Combustor/combustion chamber.
- 55. Timing gear valve actuator.
- 56. Valve for round toroid cylinder (with counter balanced actuator lever and or roller tip).
- 56A. Valve for round toroid cylinder in a double valve configuration.
- 57. Exhaust port.
- 58. Piston top with enhanced rings.
- 59. Top seal point.
- 60. Exhaust manifold.
- 61. Accumulator by-pass neck.
- 62. Diffuser.
- 63. Combustor water jacket.
- 64. Regeneratively cooled/heated fuel supply turbinals.
- 65. Inner stratified flashover reaction cage.
- 66. Combustor intake low pressure valves.
- 66A. One way low pressure valves.
- 67. Valve for rectangular toroid cylinder (with counter balanced actuator lever and or roller tip).
- 67A. Valve for rectangular toroid cylinder in a double valve configuration.
- 68. Fresh air exhaust and purge.
- 69. Reserve air tank.

- 70. 12v. Electric air pump.
- 71. Supercharger.
- 72. Spark plug/electrode.
- 73. Piston roller bearing.
- 74. Hybrid diffuser / auxiliary air / water cooled steam generator.
- 75. Pump intake port.
- 76. Round piston assembly can include enhanced piston rings, concave top and slopped backs.
- 76A. Rectangular piston assembly can include enhanced piston rings, concave top and slopped backs.
- 77. Water or coolant line.
- 78. Waste gas purge tube.
- 79. Lube oil ducts with piston rings and supply lines.
- 80. Enhanced piston rings.
- 81. Reversed exhaust purge valve.
- 82. Stylized turbo charger.
- 83. Valve actuator lever.
- 84. Scaled piston.
- 85. Shock absorbing valve impact pad.
- 86. Valve pivot and water inlet.
- 87. Piston water supply.
- 88. Water or steam recovery line.
- 89. Mini turbo charger.
- 90. Covers.
- 91. Reinforced combustor mount frame.
- 92. Internal coolant reservoir.
- 93. Coolant pick up tube.
- 94. Thermoelectric condenser.

- 95. Coolant filler cap.
- 96. Radiator and fan.
- 97. Expansion chamber.
- 98. Oil filler cap.
- 99. Oil cooling system.
- 100. Oil reservoir.
- 101. Oil pick up tube with filter.
- 102. Valve shield.
- 103. Exhaust pipe heat transfer diffuser/ egd. electrode.

Summary of Invention

In accordance with the present invention, a revolving piston, variably shaped toroidal cylinder valved expandable chamber device with an outer toroidal cylinder housing assembly connected to a valve that acts to isolate one or more matching variably shaped pistons which are attached to a central balanced rotor. The latter being attached to a central axle, supported by bearings and or bushings with an exhaust port's position determined by the amount of pistons contained on its rotor.

Descriptions-Fig. 1 through 30

The circular/circular (round) toroidal cylinder assembly 34A in figure 1 represents the basic structure of the larger size embodiments of the invention, smaller sizes might simply be stamped or poured in one piece. In figure 1 the external support convex conical structure 30 and the ribbed external support heat transfer structure 31 can be one piece also the perimeter bolt holes 37, the outer bearing bevels 36 and part of the axle shaft area 35 are part of this structure. The internal support concave conical structure 32 can be made in one piece along with the ribbed internal support heat transfer structure and water jacket element 33. The internal toroidal cylinder structure 34 has a smooth inner surface and comprises the piston cylinder area 40, the rotor area 39, the outer 38 and the inner 44 ring seal grooves, the inner bearing bevels 36A and part of the axle shaft area 35. Referring to figure 2 and supplemental to figure 1 the concave piston face 40A, the piston sloped back 41 attached to the rotor 39A which is attached to the axle shaft 49 supported by the two inner 47 and two outer 42 bearings who are in turn held in place by the retainers 43 and 50. The outer rotor seal 48 protects the outer ring seal 46 which in turn surrounds the inner ring seal 45. Figure 3 is one of the preferred embodiments of this invention an internal combustion engine in the circular/circular torus 34A, piston(s) 76 and valve(s) 56 configuration with one version of the appropriate counter balanced actuator lever and valve 56 actuator 55, pistons 76 and combustor 54 attached to the cylinder 34A, top seal point 59. The combustor accumulator by pass-neck 61 attached to the combustor 54 comprising a diffuser 62, double inner reaction flash over cages 65 with fuel regenerative turbinal heaters 64, primary inner air supply lines with check valves 52 secondary air supply lines with check valves 51 and fuel supply lines with check valves 53 all supply lines with combustor intake low pressure valves 66. Also attached at a position determined by the number of pistons in order to achieve dynamic balance is the exhaust port 57 and exhaust manifold 60. Figure 4 also a preferred embodiment of the invention as is figure 3 an internal combustion engine only this version is of a rectangular torus 34B, piston(s) 76A and valve(s) 67. Also shown fresh air exhaust purge 68 connected to cylinder 34B, piston roller 73 on piston tips 76A. Also in this figure primary air supply 52 is connected to supercharger 71 and reserve air pressure tank 69 connected to 12 volt electric air

pump 70 all of which seems to rest on combustor water jacket 63 and lastly for this figure attached to the combustor 54 and leading into the inner stratified flash over reaction cage 65 is spark plug/electrode 72.

Figure 5 the engines position is what mainly differentiates it from figure 4 also included is the hybrid diffuser/auxiliary air/water cooled steam generator.

Figure 6 the only way that this version differs from previous versions of cylindrical/cylindrical (round) internal combustion engines is that it is a double valve version. Figure 7 differs from figure 6 only in that it is a two piston version in a rectangular configuration. Figure 8 this is a pump embodiment of the invention in a rectangular configuration also notice that the valve 67 is installed in a reverse manner that is it opens toward the approaching piston's 76A sloped back 41 which in yet other versions can extend to the top of the receding piston 76A and it may have a one way low pressure valve 66A also notice pump intake port 75 its position and shape can vary.

Figure 9 embodies the internal combustion engine in its round configuration as stated in earlier figures, what is new about this figure is the waste gas purge tube 78, valve pivot and water inlet 86, piston water supply 87, water recovery line 88 and stylized turbo charger 82.

Figures 10, 11, 12, 13, 14 and 15 illustrate the rotational sequence of the rotor 39A and the pistons 76 in relation to the position of the valve 67.

Figure 16 is the front view of a preferred embodiment the internal combustion engine the reinforced combustor mount frame 91, internal coolant reservoir 92, includes coolant pick up tube 93, coolant filler cap 95, connected to the thermoelectric condenser 94, connected to radiator and fan 96, connected to expansion chamber 97, next to perimeter bolts 37a, oil filler cap 98 connects to oil reservoir 100, connected to oil cooling system 99, oil pickup tube 101, connected to axle shaft 99.

Figure 17 is a color representation of the continuous combustion engine embodiment of the invention as illustrated in figure 3 and figure 9 except that it additionally includes a valve shield 102 within the combustor 54, a valved fresh air/ exhaust purge 68 connected to the toroid cylinder 34 and a water or steam recovery line 88.

Figure 18 is an exploded schematic isometric front view of the invention in a preferred embodiment

as a continuous internal combustion engine in a rectangular toroidal cylinder **34B** configuration whose exterior may be air cooled utilizing an outer bearing support heat transfer structure **34C** and a combustor **54**.

Figure **19** is a side view of the above embodiment also showing that it is in a two piston **75A** rotor **39A** configuration and showing its fresh air **68** exhaust purge system **78**.

Figure **20** is the same embodiment as figures **18** and **19** except that it is in a round cylinder configuration.

Figure **21** is also an internal combustion engine embodiment except that this version is an air breathing or air sucking version not force fed air as other continuous internal combustion models. Illustrated are a combustor **54** including a spark plug or electrode **72**, a primary inner air supply line with check valves **52**, a secondary air supply line with check valves **51**, secondary air intake **51A**. Also included are two valve actuator levers **83**, a reversed exhaust purge valve **81**, scaled pistons **84** and **76A**, an exhaust port **57**, an exhaust manifold **60** and two shock absorbing valve impact pads **85**.

figure **22** is a rendition of the three piston **76** single rotor **39A** round configuration of the engine embodiment illustrating a small turbocharger **89** connected to the combustor **54** and to the round toroid cylinder assembly **34A**.

Figures **23**, **24**, **25** and **26** are different views of the same air cooled engine with three round pistons **75** connected to a rotor **39A** encased in a whole round toroidal cylinder assembly **34A** with a combustor **54** and optional covers **90** showing finished view of this engine with ribbed external support heat transfer structures **31** and attached exhaust port **57** and exhaust manifold **60** to waste gas purge tube **78** also with side view.

Figures **27**, **28**, **29** and **30** illustrate the same as figures **23**, **24**, **25** and **26** except in a rectangular toroid version with an extended exhaust port **57** and no purge tube **78**.

Operation— Main Embodiments

Figure 1 is a schematic isometric front view of one type of the rp-7v circular/circular (round) version of the toroidal cylinder assembly 34A which represents the basic structure of the larger size embodiments of the invention, smaller sizes might simply be cast or stamped in one piece.

This invention in its embodiment as an internal combustion engine, a version of which is represented by combining figures 1, 2 and 3 which demonstrate the following: fuel is supplied by a high pressure fuel pump through the fuel supply lines with check valves 53 and the regeneratively cooled/heated fuel supply turbinals to the inner reaction cage 65 within the combustor 54 which is attached to the toroidal cylinder assembly 34A, where it is impinged upon (preferably from the opposite direction) and mixed with air from the primary inner air supply lines with check valves 52 supplied by a supercharger 71 and/or a turbocharger 82 or even the inventions embodiment as a pump in this case an air pump Figs. 5, 8 and 8A then ignited by a spark/electrode 72 (see figure 9) within the reaction cage 65. At this point the mixture is considered rich to guarantee ignition. Once the combustion exits the inner reaction cage 65 it is mixed further with air that is supplied by the secondary air supply lines with check valves 51 and leaned out further enhancing combustion and minimizing the creation of hydrocarbons. At this point the combustion gases may flow through a diffuser 62 and through the combustor accumulator by-pass neck 61 and onto the piston top 58 with enhanced rings 58 in position to receive it forcing said piston forward as the valve 56 in its closed position prevents the retrograde exiting of gases and at the same time guarantees rotational direction. The gases continue expanding and pushing the piston 58 forward until it reaches the exhaust port 57. The position of the exhaust port 57 on the toroid cylinder assembly 34A is determined by the number of pistons 58 on the rotor 39a needed to achieve dynamic balance. Once the piston 58 reaches the exhaust port 57 the piston 58 following it will simultaneously reach the top seal point 59 and the cycle will repeat itself. As the piston 58 reaches the exhaust port 57 and the exhaust empties into the exhaust manifold 60 it may power a turbo charger 82 and/or contain another water cooled diffuser that further extracts heat from the

flow in order to supply supplemental steam power or for thermoelectric extraction. At this point an electrogasdynamic device (EGD from MHD) may be added under certain conditions to produce electric power. Figure 4 functions in the same way as the previous only that it is in the rectangular configuration as it would function in any shape be it oval or triangular etcetera. Figure 5 also in a rectangular configuration would function in a similar way the only difference being the engine's position relative to the others. With the combustor 54 facing vertically the effect of gravity on the valve 67 can be practically eliminated.

Figure 6 in most aspects like the previous versions only that this version has a double valve 67A air lock type configuration that assures an even better lock out of retrograde exhaust flow.

Figure 7 same double valve 67A as figure 6 only in a rectangular torus 34B configuration.

Figure 8 is the invention in one of its embodiment as a pump the main differences here being the lack of a combustor 54 replaced by inlet 75 and a reversed valve 67 that is a valve that faces and opens toward the rotation of the pistons 76A and rotor 39A riding or rolling on said rotor and sloped back pistons 41 thereby decreasing the chamber volume and forcing the air or water etc. to exit exhaust port 57 and exhaust manifold 60 until valve 67 closes the exhaust manifold 60 may contain a one way low pressure valve 66A.

Figure 8A is the same basic design and function as fig. 8 except that valve 67 does not seat and close completely against the interior of rectangular toroidal cylinder assembly 34B allowing working fluid or air to pass by more dynamically utilizing the accumulator by pass neck 61 the pressurized fluid or air is then trapped the one way low pressure valve 66A.

Figure 9 is similar in basic design to the previous versions of round torus internal combustion engine version except that it shows additionally an exhaust purge tube 78 that connects to the exhaust manifold 60. Oil 79 and water 87 lines feed through the axle shaft 49 separately and into the rotor 39A and piston heads 76. The oil then seeps out between the piston rings 58 and in again through the oil inlets 79 to be pumped down to the oil cooler 99 to be recirculated. The coolant or water is routed through the piston 76 and returned to be cooled and/or its steam to be collected. Also shown is a water cooled diffuser/steam generator 62, a steam or

water recovery tube 88 and a stylized turbo charger 82 in the exhaust manifold 60. The combustor 54 generates the gases that move the pistons 76 and utilizes a turbinal regenerative cooler/heater 64 that vaporizes the fuel while cooling the combustor 54. Also this version may utilize a pivoting water cooled valve 56 and valve pivot and water inlet 86.

Figures 10, 11, 12, 13, 14 and 15 represent the rotational sequence of the rotor 39A and pistons 76A in relation to the position of the valve 67 in most embodiments of the invention. Figure 16 is a isometric schematic front edge on view of a version of the invention in its round piston cylinder 76 configuration in which a different angle of the oil 100 and water 92 reserve compartments is illustrated and their distribution through the axle shaft 49, rotor 39A and through their various routes from reservoir through their design function, through their respective cooling processes oil 99 and coolant or water expansion chamber 97, radiator and fan 96, thermoelectric condenser 94 and back again. Also shown is the way the combustor 54 is attached to the toroid cylinder 34A. This compound compartmentalized version is one of various configurations.

Figure 17 is a color rendition of the invention in it's embodiment as an internal combustion engine. It clearly shows the basic process that powers this engine. Additionally it shows the fresh air/exhaust tube 68 which allows a type of conditioning of the piston 76 and cylinder area 34 prior to its cycling back to its combustion position. It also show a hot water or steam recovery line 88. In summary basically what this figure shows is the way that the combustor 54 drives the piston 76, is isolated from the retrograde flow by the valve 56 and is exhausted through the exhaust port 57 and manifold 60.

Fig. 18 is an exploded schematic isometric front view of the invention in a preferred embodiment as an internal combustion engine in a rectangular/rectangular configuration whose exterior may be air cooled. The cooling vanes 34C also act as bearing supports.

Fig. 19 is a side view of the above embodiment also showing that it is in a two piston 76A rotor 39A configuration and showing its fresh air 68 exhaust purge 78 system.

Fig. 20 is the same embodiment as Fig. 18 and Fig. 19 only that it is in a round cylinder configuration.

Fig. 21 is also in an internal combustion embodiment except that this version is an air breathing or sucking version meaning that this version is not force fed air as the other continuous combustion models. As a consequence this model cycles between detonations in order to supply itself with the fresh air necessary for combustion. Additionally this model is also a double valve 67 & 81 version in which the exhaust purge valve 81 faces the opposite direction from the traditional piston isolating valve 67 in this version as well as in others.

As the piston 76A cycles around as shown in this figure the exhaust purge valve 81 and the valve 67 create a partial vacuum causing secondary air intake with check valves 51A to draw air into that space. The continuing rotation and the closing of valve 67 cause air to be forced through the secondary air supply line with check valves 51 and into the combustor 54 combining with fuel in the inner reaction cage. At the same time the preceding piston 76A is expanding the chamber outside the area isolated by the two valves drawing in air through the primary inner air supply with check valves 52 mixing it with fuel within the inner stratified flashover reaction cage 65. At this time the spark plug/electrode 72 flashes and the mixture is ignited forcing the rotor 39A and pistons 76A to turn. This turning evacuates the exhaust gases through the exhaust port 57 and manifold 60 initiating the process all over again.

Fig. 22 the only difference in this embodiment of the round toroid cylinder engine is that it has a small turbocharger 89 that runs off of the purged exhaust gases to draw in fresh air to supplement the air in the combustor 54 for combustion.

Figs. 23, 24, 25 and 26 are different views of the same engine and indicate that it is a round air cooled toroid cylinder with optional covers 90 that would either concentrate heat for steam generation or for converting it into a water cooled version and Fig 25 also helps one visualize what the exterior of this engine would look like.

Figs. 27, 28, 29 and 30 illustrate the same as Figs. 23, 24, 25 and 26 except in a rectangular toroid version with an extended exhaust port 57 eliminating the need for a purge tube 78.

Conclusion, Ramifications and Scope

This invention in its internal combustion mode is more efficient due to the following reasons:

It is a rotary engine in it's purest form. It does not waste energy in useless vibration caused by off center rotation. It runs on a single cycle; that is, there is no compression cycle, no separate exhaust cycle and no separate intake cycle. Just basically one cycle that does most of the above at the same time. This engine can use almost any kind of combustible liquid or gas, even adding water to certain fuels would function. This engine overcomes the limitations of gasoline as a fuel while being more efficient in its use. This invention is more durable due to its simple design with very few moving parts (only two in its basic configuration). This invention is also easier to manufacture because it can be made stamped or cast in two halves, then bolted together or joined in some other way. Making it not only easier to build but also more economical.

The invention can be used in many ways. The following is a list of and function of some of its embodiments. Its embodiment as a very efficient internal combustion engine is well documented in these pages, so I will go on to mention some of the others. One of its versions in its internal combustion engine embodiment is that of an air breathing engine. That is an engine that sucks in the air that it will utilize for combustion rather than having the air forced in by some other external mechanical means. In this version, the engine becomes a cycled engine in which not every passing of the piston is imparted by power but rather every other and the spark is timed in a manner as to coincide with this cycle, see Fig. 21. This is one of various versions of this type of air breathing engine. In its embodiment as a pump, as illustrated in Fig. 8, this embodiment can be made in many ways. Fig. 8 shows the invention in a two square piston and cylinder configuration with a reversed valve (67). In other versions of this pump the valve need not be reversed. It can be double, it can have one or a plurality of pistons and rotors and may or may not include a one way pressure valve (66A). It can come in all sizes from nano or micro to macro or gigantic and it can be manufactured of any material that is suitable to its ultimate purpose (metal, ceramics, composites, etc.).

The valve(s) in the designs of the pump embodiments, open and close allowing the passage of a piston yet isolating it and the working fluid from the exhaust manifold insuring that it does its work and flow only in one direction. Imparting power to the axle shaft will cause the rotor with the attached balanced pistons to turn. The inlet would draw the working fluid into the expanding chamber. Once the working fluid is drawn into the chamber it is compartmentalized and sealed in by the following piston which delivers it to the exhaust port where the valve(s) purge or force it out of the device. Figs 6, 8 and 8A function in this manner.

The embodiments of the steam engine, the water engine (for hydroelectric and other purposes), the fluid metering devices, the power assist devices and the quantum motors would function in the same manner except that the working fluid would supply the force or pressure to move the piston(s) and the rotor and the rotational power would be derived from the shaft rather than be delivered to it as in the case of the pump. The valve with means for controlling said valve so that as the revolutions increase and the load decreases the valve will start to assume a less obstructive position. From opening and closing completely to a kind of rhythmic flutter or waving in tune to the passing of the pistons and acting as a fluidic amplifier until balance can be reached and maintained at which point the valve may attain a fully unobstructive position until when load increases or revolutions decrease for any reason then the valve can readily reengage and assume full range movement or operation. As with all the valves in any embodiment of this invention are and can be actuated by many means they can spring loaded, cam and lever actuated with or without a controlling governor, electrically, pneumatically, hydraulically or mechanically actuated with electronic controls or other type controls. In these illustrations the rotor and piston rotation is generally in a clockwise direction but in actuality may not be limited to this. The above variations and variations not mentioned above whether in size, materials, embodiments and functions, represent the invention in all of its actual and potential manifestations.

What is claimed:

1. A revolving piston rotary toroidal cylinder valved expandable chamber device comprising :

an outer toroidal cylinder housing assembly having a smooth interior surface,
connected to
a valve that acts to isolate one or a plurality of pistons within said toroidal
cylinder housing, said pistons having means for attachment to
a central balanced rotor, said rotor having means for attachment to a central
axle or crank shaft supported by a plurality of
bearings and or bushings, and
an exhaust port with means for attachment to said outer toroidal cylinder
housing.

2. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1, wherein said outer toroidal cylinder housing assembly, having a smooth interior surface, having said valve attached,

providing passage and isolation to said piston as a means for preventing
retrograde escape of gases, fluid, water, steam and quanta and guaranteeing
rotational direction, said gases, fluid, water, steam and quanta providing
force to said piston isolated by said valve to turn said attached rotor whereby
turning said axle or crank shaft,

providing support by said plurality of bearings and or bushings, said exhaust
port having means for attachment to said toroidal cylinder, said pistons to be
shaped with a gradually sloping back and conforming to the inner cylinder
surface, therefore easing the evacuation of exhaust.

3. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1, further comprising:
pistons to be shaped with a gradually sloped back and conforming to the inner cylinder surface,
4. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1, further comprising:
a combustor and/or combustion chamber with method for igniting an internal combustion engine.
5. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1, wherein said device also comprises means for an internal combustion engine.
6. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1, wherein said device also comprises means for Fluid Metering devices.
7. A revolving piston rotary toroidal cylinder valved expandable chamber device according to claim 1, wherein said device also comprises means for Power Assist devices.

FIG. 1

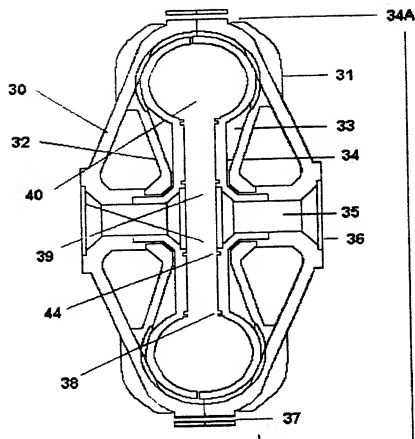


FIG. 2

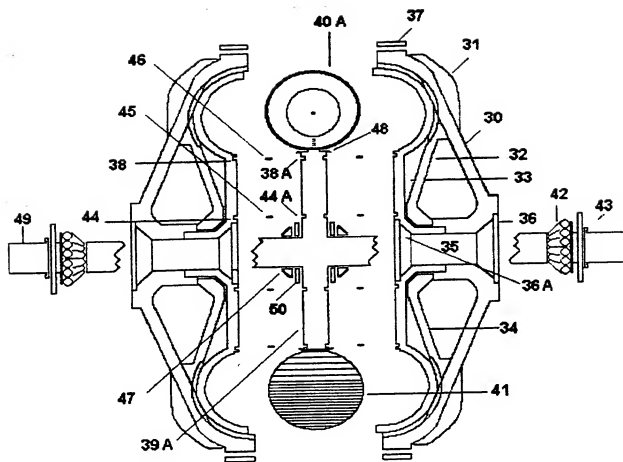


FIG. 5

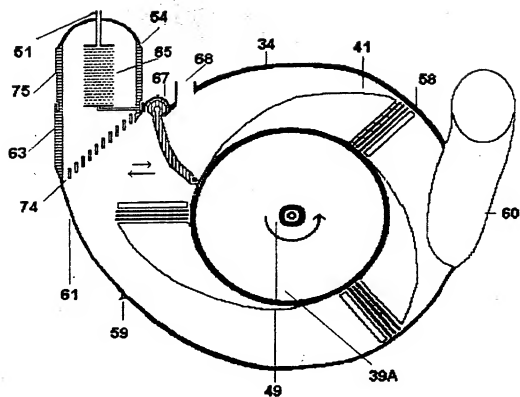


FIG. 6

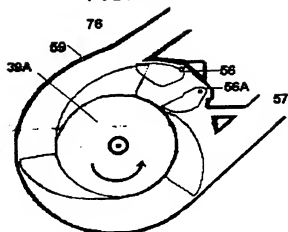


FIG. 7

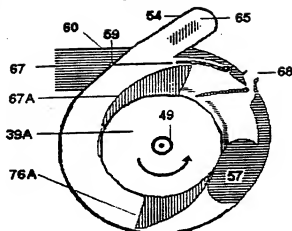


FIG. 8

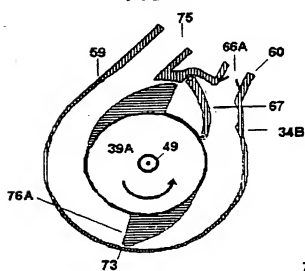
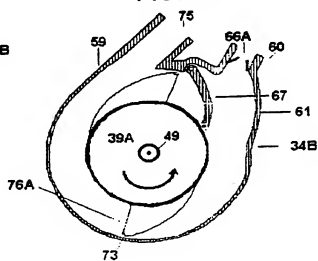


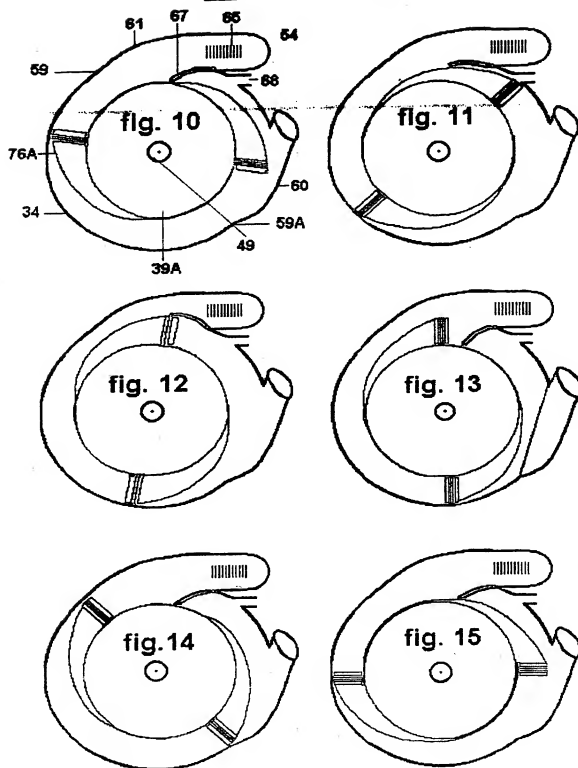
FIG. 8A

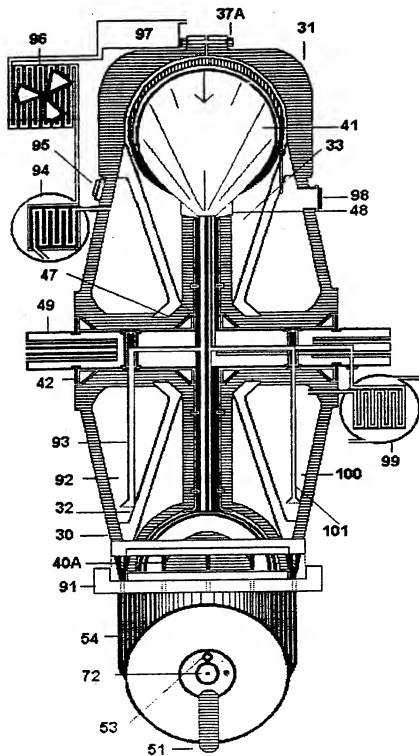


sloped back of piston may extend to
the face or top of the preceding piston

7/11

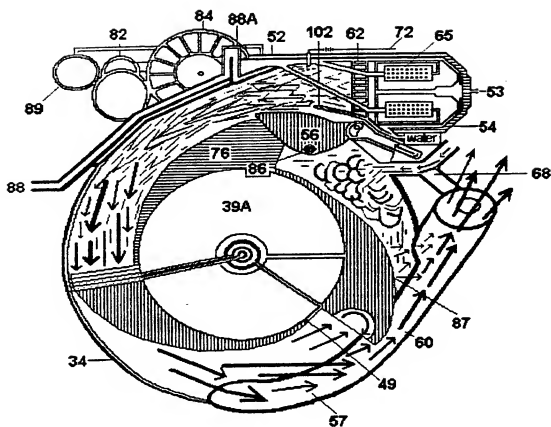
ROTATIONAL SEQUENCE





9/11

FIG. 17



10/11

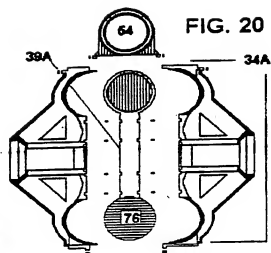
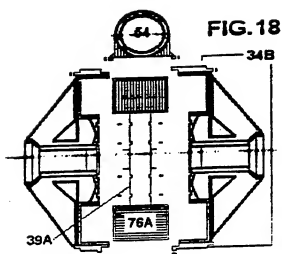


FIG. 19

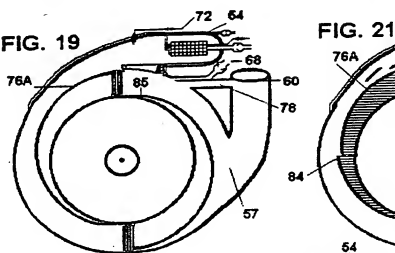


FIG. 21

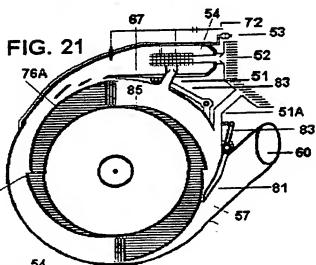
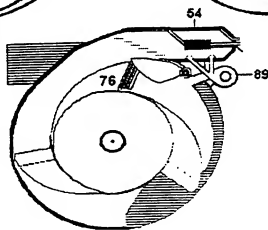
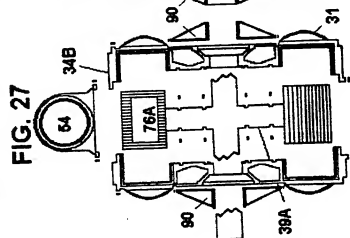
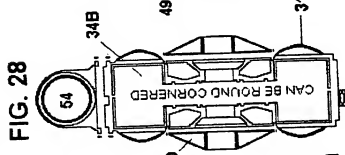
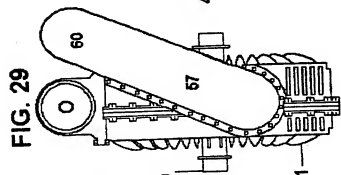
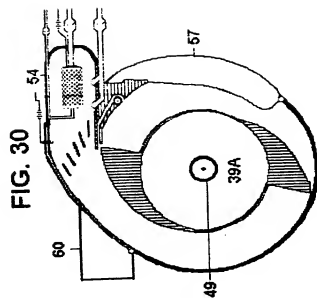
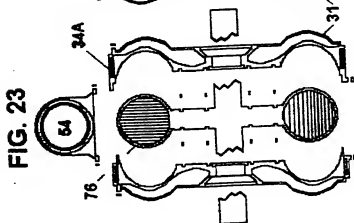
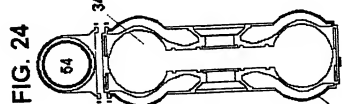
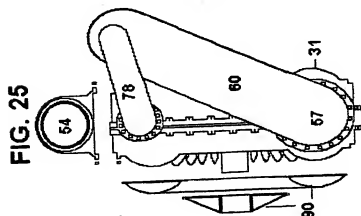
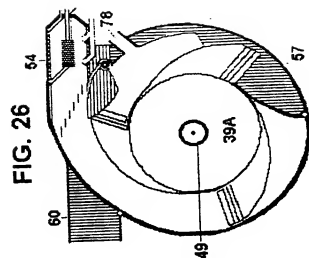


FIG. 22



11/11



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.